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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/258,961	03/01/1999	TONGBI JIANG	98-0645.1	4605

7590 05/28/2004  
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EXAMINER

PAREKH, NITIN

ART UNIT	PAPER NUMBER
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2811

DATE MAILED: 05/28/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/258,961

Applicant(s)

JIANG ET AL.

Examiner

Nitin Parekh

Art Unit

2811

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 29 March 2004.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 24-36 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 24-26 and 34-36 is/are rejected.
- 7) ☒ Claim(s) 27-33 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 03-01-99 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- 1) ☐ Certified copies of the priority documents have been received.
  - 2) ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - 3) ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948)                                    | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Request for Continued Examination***

1. A request for continued examination (RCE) under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 03/29/04 has been entered. An action on the RCE follows.

2. The amendment filed on 03/29/2004 has been entered.

### ***Claim Objections***

3. Claims 27 and 30 are objected to because of the following informalities:

A. Claim 27, line 20 and claim 30, line 23: Insert ---"a top surface of" --- between "covering" and "the".

Appropriate correction is required.

### ***Claim Rejections - 35 USC § 103***

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and

the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.

Patentability shall not be negated by the manner in which the invention was made.

5. Claims 24 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al. (US Pat. 5796586).

Regarding claim 24, Lee et al. disclose a semiconductor package comprising:

- a substrate (16 in Fig. 1A-1C) comprising a first/bottom and second/top surfaces (not numerically referenced- see Fig. 1A)
- a semiconductor die (20 in Fig. 1A) having a first outline (not numerically referenced- see the die 20 having the outline defining the die dimensions on the die attach area in the central portion in Fig. 1C) and a face being bonded directly to the second surface
- a first solder mask (14A in Fig. 1A) on the first/bottom surface of the substrate
- a second solder mask (18 in Fig. 1A) covering the second/top surface of the substrate except in a die attach area defined by an opening through the second solder mask having a second outline (see the outline/hatched area 18 in Fig. 1C) corresponding to or slightly larger than the first outline
- an adhesive layer (not numerically referenced in Fig. 1A; see Col. 6, lines 32-35) between the face and the die attach area bonding the die directly to the second/top surface of the substrate, and

- an encapsulating material/epoxy resin (25 in Fig. 1A) on the die and the second mask

(Fig. 1A-1C; Col. 1, line 34-Col. 2, line 65).

Lee et al. further teach the solder masks being made of a photoimageable material such as polyimide and being applied using suitable/patterning technique (Col. 5, line 18-45; Col. 7, line 65). Conventional patterning technique use steps of photo exposure and development of the photoimageable material to achieve the desired pattern/dimensions.

Furthermore, having the opening in the second mask comprising an exposed and developed portion do not distinguish over Lee et al., because only the final product/structure is relevant, not the process of forming the opening such as "exposing/developing", "laser etching" or "sputtering". Note that a "product by process" claim is directed to the product per se, no matter how actually made, In re Hirao, 190 USPQ 15 at 17 (footnote 3). See also In re Brown, 173 USPQ 685; In re Luck, 177 USPQ 523; In re Fessmann, 180 USPQ 324; In re Avery, 186 USPQ 161; In re Wertheim, 191 USPQ 90 (209 USPQ 554 does not deal with this issue); and In re Marrosi et al., 218 USPQ 289, all of which make it clear that it is the patentability of the final product per se which must be determined in a "product by process" claim, and not the patentability of the process, and that an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims

or not. Note that applicant has the burden of proof in such cases, as the above case law makes clear. See also MPEP 706.03(e).

Regarding claim 25, Lee et al. substantially teach the entire claimed structure as applied to claim 24 above, wherein Lee et al. further teach the second outline being only slightly larger than the first outline (see Fig. 1A-1C).

6. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al. (US Pat. 5796586) in view of Hoffman et al. (US Pat. 5360942).

Regarding claim 26, Lee et al. teach substantially the entire claimed structure as applied to the claims 24 and 25 above, except the adhesive layer comprising a filled adhesive configured to transfer heat from the face to the second surface.

Lee et al. further teach in another embodiment, the die bonding structure having different adhesives including a conductive epoxy (Col. 6, line 45-50).

Hoffman et al. teach using a die attach/adhesive material comprising a filled epoxy (40 in Fig. 3) configured to provide improved heat transfer and/or electrical conductivity (Col. 3, line 60- Col. 4, line 2).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to incorporate the adhesive layer comprising a filled adhesive configured to transfer heat from the face to the second surface as taught by Hoffman et

al. so that the adhesion, thermal performance and reliability for the package can be improved in Lee et al's package.

7. Claims 34 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over admitted prior art (APA) in view of Lee et al. (US Pat. 5796586).

Regarding claims 34 and 35, APA (Fig.1A and B; pages 2-4) discloses a semiconductor package comprising :

- a substrate (12 in Fig. 1A) comprising a first and second surfaces (24 and 22 respectively in Fig. 1A), a plurality of conductors/pads formed on the first surface and a bonding opening (26 in Fig. 1A) from the first surface to the second surface
- a semiconductor die (16 in Fig. 1A) having a first outline (not numerically referenced- see the die 20 having the outline defining the die dimensions on the die attach area in the central portion in Fig. 1C) and a face being aligned with the bonding opening and attached/bonded face down to the second surface on a die attach area using an adhesive (34 in Fig. 1A)
- first mask (20A in Fig. 1A) on the first surface of the substrate
- a second mask (20B in Fig. 1A) substantially covering a second surface of the substrate
- the adhesive layer between the die/face and the substrate in the die attach area to bond the die to the second mask and the substrate

- a plurality of wires (28 in Fig. 1A) placed through the bonding opening and wire bonded to the die and being in electrical communication with the respective conductors
- an encapsulating material/epoxy resin (38 in Fig. 1A) on the die and the second mask, and
- a glob top/polymer (40 in Fig. 1A) in the bonding opening encapsulating the wire.

APA further teaches the solder masks being made of a photoimageable material and being patterned using conventional exposure and development of the photoimageable material (see page 3; line 31- page 4, line 6).

APA fails to teach:

- a) the die being bonded directly to the second surface, the second surface having the second mask including an opening there through having a second outline corresponding to but only slightly larger than the first outline, and
- b) the adhesive layer bonding the die directly to the second surface.

a) Lee et al. teach using a second mask having an opening through the mask with a second outline (see hatched mask area 218' with a second outline- Fig. 7; Col. 7, line 55) corresponding to or only slightly larger than the first outline (see the outline of the die 220 and the area 218' in Fig. 4 and Fig. 7) on the second surface so that the die



is directly bonded to the second surface to provide an area with improved adhesion with the substrate (see abstract: lines 8-11; Fig. 7 and Fig. 1-6; Col. 1-8).

b) Lee et al. further teach the die bonding structure where the die is attached directly to the substrate surface using a variety of adhesives including the conductive/filler-based epoxy (not numerically referenced in Fig. 7; Col. 6, lines 30-50).

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the die being bonded directly to the second surface, the second surface having the second mask including an opening there through having a second outline corresponding to but slightly larger than the first outline and the adhesive layer bonding the die directly to the second surface as taught by Lee et al. so that the adhesion, bonding to the substrate and the reliability of the package can be improved in the APA.

Regarding claim 34, having the opening in the second mask comprising an exposed and developed portion do not distinguish over APA and Lee et al., because only the final product/structure is relevant, not the process of forming the opening such as "exposing/developing", "laser etching" or "sputtering". Note that a "product by process" claim is directed to the product per se, no matter how actually made, In re Hirao, 190 USPQ 15 at 17 (footnote 3). See also In re Brown, 173 USPQ 685; In re Luck, 177

USPQ 523; In re Fessmann, 180 USPQ 324; In re Avery, 186 USPQ 161; In re Wertheim, 191 USPQ 90 (209 USPQ 554 does not deal with this issue); and In re Marrosi et al., 218 USPQ 289, all of which make it clear that it is the patentability of the final product per se which must be determined in a "product by process" claim, and not the patentability of the process, and that an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims or not. Note that applicant has the burden of proof in such cases, as the above case law makes clear. See also MPEP 706.03(e).

8. Claim 36 is rejected under 35 U.S.C. 103(a) as being unpatentable over APA and Lee et al. (US Pat. 5796586) as applied to claim 34 above, and in further in view of Hoffman et al. (US Pat. 5360942).

Regarding claim 36, APA and Lee et al. teach substantially the entire claimed structure as applied to the claim 34 above, except the adhesive layer comprising a filled adhesive.

Lee et al. further teach in another embodiment, the die bonding structure having different adhesives including a conductive epoxy adhesive (Col. 6, line 45-50).

Hoffman et al. teach using a die attach/adhesive material comprising a filled epoxy/adhesive (40 in Fig. 3) configured to provide improved heat transfer and/or electrical conductivity (Col. 3, line 60- Col. 4, line 2).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to incorporate the adhesive layer comprising the filled adhesive configured to transfer heat from the face to the second surface as taught by Hoffman et al. so that the adhesion, thermal performance and reliability for the package can be improved in Lee et al. and APA's package.

#### ***Response to Arguments***

8. Applicant's arguments filed on 03-29-04 with respect to claims 24-26, 34 and 35 have been addressed in the rejections above.

#### ***Allowable Subject Matter***

9. Claims 27-33 would be allowable if rewritten to overcome the objections of the base claims set forth in this Office Action.

#### ***Reasons for Allowance***

10. The following is an examiner's statement of reasons for allowance:

The references of record do not teach either singularly or in combination at least the limitations "a semiconductor die having a first outline and a face being bonded directly to the second surface", "a second mask on the second surface comprising a second opening having a second outline corresponding to a first outline defining an open die attach area on the second surface" and "a resin encapsulating the die and

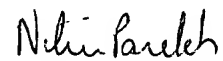
covering a top surface of the second mask" as recited in the independent claim 27; and "a semiconductor die on the die attach area having a face aligned with the bonding opening attached directly to the second surface", "a second mask on the second surface except in a die attach area defined by an opening in the second mask" and "a resin encapsulating the die and covering a top surface of the second mask" as recited in the independent claim 30 in an encapsulated package having a first and second solder masks on first and second surfaces of a substrate respectively and a die being bonded directly on the second surface of the substrate.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nitin Parekh whose telephone number is 703-305-3410. The examiner can normally be reached on 09:00AM-05:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Lee can be reached on 703-308-1690. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-306-3431.



NITIN PAREKH

PATENT EXAMINER

TECHNOLOGY CENTER 2800

05-26-04

NP